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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/642,959	08/21/2000	Bryan K. Choo	E0778	7850

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EXAMINER	
HESSELTINE, RYAN J	
ART UNIT	**PAPER NUMBER**
2623	6

DATE MAILED: 09/26/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/642,959	CHOO ET AL.	
	Examiner	Art Unit	
	Ryan J Hesseltine	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 August 2000* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) *14-18* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13 and 19-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 August 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☒ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

   I. Claims 1-13 and 19-26, drawn to a system and method for evaluating optical proximity corrected designs, classified in class 382, subclass 149.

   II. Claims 14-18, drawn to a system for optimizing OPC design factors, classified in class 382, subclass 145.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, invention I has separate utility such as a system for evaluating optical proximity corrected (OPC) designs, and invention II has separate utility such as OPC design performance optimization. See MPEP § 806.05(d).

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Mr. Thomas G. Eschweiler on August 25, 2003 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-13 and 19-26. Affirmation of this election must be made by applicant in replying to this Office action. Claims 14-18 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Oath/Declaration

6. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because:
It does not identify the provisional application on which priority is claimed pursuant to 35 USC 119(e) by specifying the application number, day, month and year of its filing.

Claim Objections

7. Claim 7 is objected to because of the following informalities: claim 7 states that "the evaluation of OPC designs is determined by graphical comparisons of the first image and the second shape." It is believed that applicant intended this to read, "...first image and second *image*." Appropriate correction is required.

Double Patenting

8. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground

provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

9. Claims 1, 3-6, 10, 19, 20, 22, and 26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 3, 4, 6, 11, and 12 of U.S. Patent No. 6,510,730 to Phan et al., hereafter Phan. Although the conflicting claims are not identical, they are not patentably distinct from each other because the differences between the claims would have been obvious to one of ordinary skill in the art.

10. Regarding claims 1 and 5, claim 1 of the patent to Phan claims a system for evaluating optical proximity corrected (OPC) designs (line 1-2), comprising: an analysis (measurement) system for performing measurements relating to at least one segment (portion) of a feature (pattern having a respective OPC design; line 3-5); wherein the analysis (measurement) system is configured to determine (characterize at least a portion of the feature pattern as) a first image corresponding to (based on) the at least one segment of the feature (the measurements; line 6-8); the analysis (measurement) system determines (employing) a second image to facilitate analysis of the first image (line 8-10); the analysis (measurement) system evaluates (facilitates evaluation of the respective) OPC designs based upon comparisons of the first and second images (line 10-12). Claim 1 of Phan further claims that the evaluation of the OPC designs is determined by graphical comparisons of the first and second images (line 10-12). Claim 1 of Phan does not claim an analysis system, but the claimed measurement system performs substantially the same operations as the claimed analysis system. Phan includes the added limitations that the feature is a pattern having a respective OPC design and the segment is at least a portion of the feature

pattern, which would have been obvious to one of ordinary skill in the art at the time the invention was made.

11. Regarding claims 1 and 6, claim 11 of the patent to Phan claims a system for evaluating optical proximity corrected (OPC) designs (line 1-2), comprising: an analysis (measurement) system for performing measurements relating to at least one segment (portion) of a feature (pattern having a respective OPC design; line 3-5); wherein the analysis (measurement) system is configured to determine (characterize at least a portion of the feature pattern as) a first image corresponding to (based on) the at least one segment of the feature (the measurements; line 5-7); the analysis (measurement) system determines (employing) a second image to facilitate analysis of the first image (line 7-9); the analysis (measurement) system evaluates (facilitates evaluation of the respective) OPC designs based upon comparisons of the first and second images (line 11-13). Claim 11 of Phan further claims that the second image is determined from a corresponding segment (portion) of an ideal feature (line 9-11). Claim 11 of Phan claims a measurement system instead of an analysis system and includes the added limitations that the feature is a pattern having a respective OPC design and the segment is at least a portion of the feature pattern (see above discussion of claims 1).

12. Regarding claim 10, claim 6 of the patent to Phan claims that the comparison of the first and second images provides information relating to corner rounding, end rounding, or structure pull-back.

13. Regarding claims 19 and 20, claim 12 of the patent to Phan claims a system for evaluating optical proximity corrected (OPC) designs (line 1-2), comprising: means for performing measurements relating to at least one segment of a feature (pattern having a

respective OPC design; line 3-5); means for determining a first image corresponding to the at least one segment of the feature (feature pattern; line 6-7); means for determining a second image to facilitate analysis of the first image (line 8-9); and means for evaluating OPC designs based upon comparisons of the first and second images (line 10-11). Claim 12 of Phan includes the added limitation that the feature is a pattern having a respective OPC design, but this is a limitation that would have been obvious to one of ordinary skill in the art at the time the invention was made. While Phan claims a system in claim 12, the claimed limitations are applicable to a method as in claim 20 of the instant application.

14. Regarding claims 3 and 22, claim 3 of the patent to Phan claims that the second image is determined from a corresponding segment (portion) of another feature (feature pattern) having a different OPC design.

15. Regarding claim 4, claim 4 of the patent to Phan claims that the second image is determined from a corresponding segment (portion) of another feature (feature pattern) having a different mask fabrication process.

16. Regarding claim 26, claim 12 of the patent to Phan claims a system for evaluating optical proximity corrected (OPC) designs (line 1-2), comprising: a processing system (means) for performing measurements relating to a feature (pattern having a respective OPC design; line 3-5); wherein the measurement system is configured to determine (means for determining) a first image for the at least one segment of the feature (feature pattern; line 6-7); the processing system determines (means for determining) a second image to facilitate analysis of the first image (line 8-9); the processing system evaluates (means for evaluating) OPC designs based upon comparisons of the first and second images (line 10-11). Phan does not claim that the system is a

CD-SEM (critical dimension-scanning electron microscope) system or that measurements are taken as a sequence of measurements over a distance, however, the examiner takes Official Notice that such measurement is well-known in the image analysis art such as line-scanning a two-dimensional area, or in the wafer manufacturing art as a step-and-repeat scanner or scanning electron microscope.

Claim Rejections - 35 USC § 102

17. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

18. Claims 1, 2, 6, 9, 10, 13, 19, 20, 21, and 24-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Garza et al. (USPN 6,078,738, newly cited), hereafter Garza.

19. Regarding claims 1, 19, and 20, Garza discloses a system and method for evaluating (comparing differences in) optical proximity corrected (OPC) designs (column 3, line 17-26), comprising: means (an analysis system) for performing measurements (e.g. line width) relating to at least one segment (portion) of a feature (column 5, line 52-63); means for determining (wherein the analysis system is configured to determine) a first image (SEM image digitized to produce second database) corresponding to the at least one segment of the feature (column 9, line 14-21); means for determining (the analysis system determines) a second image (simulated aerial image digitized to produce a first database) to facilitate analysis of the first image (column 9, line

3-14); and means for evaluating (the analysis system evaluates) OPC designs based upon comparisons of the first and second images (column 9, line 24-37).

20. Regarding claim 2, Garza discloses that the analysis system is a CD-SEM (critical dimension scanning electron microscope) system (column 1, line 55-66; column 4, line 5-9).

21. Regarding claims 6 and 24, Garza discloses that the second image (simulated aerial image) is determined from a corresponding segment of an ideal (desired) feature (column 3, line 8-14).

22. Regarding claim 9, Garza discloses that the comparison of the first and second image is based upon digital (both images are digitized) subtraction (error database indicative of differences; column 4, line 55-61).

23. Regarding claim 10, Garza discloses that the comparison of the first and second image provides information relating to corner rounding, end rounding (shortening of terminal portions; column 5, line 55-60), or structure pull-back (shrinking of line width; column 6, line 30-32).

24. Regarding claims 13 and 21, Garza discloses that the measurements (image) relating to the at least one segment of the feature is determined from a sequence of measurements that are recorded over a distance (discrepancies shown as displacement from idealized pattern along pattern edges; Figure 3; column 6, line 23-32).

25. Regarding claim 25, Garza discloses that the evaluation of the first and second image is determined from comparisons of the first image and the ideal feature (column 9, line 24-37).

26. Regarding claim 26, Garza discloses a CD-SEM system for evaluating (comparing differences in) optical proximity corrected (OPC) designs (column 3, line 17-26), comprising: a processing system for performing measurements (scanning electron microscope image) relating

to at least one segment (portion) of a feature (column 9, line 14-19); wherein the measurements are taken as a sequence of measurements over a distance (discrepancies shown as displacement from idealized pattern along pattern edges; Figure 3; column 6, line 23-32), the processing system is configured to determine a first image (SEM image digitized to produce second database) for the at least one segment of the feature based on the measurements (column 9, line 14-21); the processing system determines a second image (simulated aerial image digitized to produce a first database) to facilitate analysis of the first image (column 9, line 3-14); the processing system evaluates OPC designs based upon comparisons of the first and second images (column 9, line 24-37).

Claim Rejections - 35 USC § 103

27. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

28. Claims 3 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Garza as applied to claims 1 and 20 above, and further in view of Leroux et al. (USPN 5,962,173, cited on applicant's IDS paper no. 4), hereafter Leroux.

29. Regarding claims 3 and 22, Garza does not disclose that the second image is determined from a corresponding segment of another feature having a different OPC design. Leroux discloses a method for measuring the effectiveness of optical proximity corrections wherein several test patterns, each with a different form of optical proximity correction, can be lithographed onto a single wafer for comparative review of the different correction schemes

(abstract; column 7, line 16-19 and 38-46). It would have been obvious to one of ordinary skill in the art at the time the invention was made to compare two images of corresponding features having a different OPC design as taught by Leroux in order to compare the different correction schemes to determine which more accurately approximates the ideal pattern (column 3, line 1-14).

30. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Garza as applied to claim 1 above, and further in view of Sugawara (USPN 5,698,346, cited on applicant's IDS, paper no. 4).

31. Regarding claim 4, Garza does not disclose that the second image is determined from a corresponding segment of another feature having a different mask fabrication process. Sugawara discloses a photomask pattern shape evaluation method wherein the second image is determined from a corresponding segment of another feature havening a different mask fabrication (manufacturing) process (exposure latitude, depth of focus, etc.; column 10, line 34-59). It would have been obvious to one of ordinary skill in the art at the time the invention was made to determine the second image from a corresponding segment of another feature having a different mask fabrication process as taught by Suguwara in order to adjust the exposure latitude, depth of focus, etc. to correspond with the other feature (column 2, line 11-27; column 5, line 12-35).

32. Claims 5, 7, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Garza as applied to claims 1, 6, and 20 above, and further in view of Kenan et al. (USPN 6,268,093, newly cited), hereafter Kenan.

33. Regarding claims 5, 7, and 23, Garza does not disclose that the evaluation of OPC designs is determined by graphical comparisons of the first and second images. Kenan discloses a method for reticle inspection using aerial imaging wherein the system uses the results of the line width measurements for individual dies of the reticle to generate a map of the line width variations (comparisons) for the entire reticle which is then displayed to the user in graphical format (column 11, line 59-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to determine the evaluation of OPC designs graphically as taught by Kenan in order to provide a useful method for visualizing how the amount of variation in line width changes from die-to-die on the reticle (column 11, line 63-column 12, line 3).

34. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Garza as applied to claim 1 above, and further in view of Garza et al. (USPN 5,723,233, newly cited), hereafter Garza '233.

35. Regarding claim 8, Garza does not disclose that the evaluation of OPC designs is determined by a regression analysis. Garza '233 discloses an optical proximity correction method and apparatus wherein a non-linear mathematical expression generated by curve fitting data (regression) ascertains the degree of correction required (evaluation) for patterns having critical dimensions in a non-linear domain (column 6, line 6-12). It would have been obvious to one of ordinary skill in the art at the time the invention was made to evaluate OPC designs using non-linear mathematical expressions generated by curve fitting data as taught by Garza '233 in order to accurately depict reticle designs having very small critical dimensions (column 4, line 3-20; column 5, line 66-column 6, line 6).

36. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Garza as applied to claim 1 above.

37. Regarding claim 11, Garza discloses that the simulator 140 comprises a computer 141 including an input device for receiving the input information (column 6, line 61-column 7, line 5), but does not disclose that the at least one segment is determined manually. It would have been obvious to one of ordinary skill in the art at the time the invention was made to allow the at least one segment to be determined manually for example using an input device as taught by Garza in order to allow a user or operator to inspect a desired area of a semiconductor substrate (column 9, line 37-48).

38. Regarding claim 12, Garza discloses that the first and second image are aligned with respect to one another using alignment marks to facilitate comparison of the images (column 9, line 21-26), but does not disclose that the two images are aligned by minimizing a sum of the squares distance between the respective images. The examiner takes Official Notice that aligning two images by minimizing a sum of the squares distance between the respective images is well known in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to align the two images by minimizing the sum of squares distance between alignment marks of the respective images as taught by Garza in order to quickly and accurately align the two images for subsequent comparison (column 4, line 10-15).

Conclusion

39. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. USPN 6,194,104 to Hsu discloses an optical proximity correction (OPC) method for

improving lithography process window including approximating corners and line ends by fitting curves to the pattern. USPN 6,329,107 to Lu discloses a method of characterizing partial coherent light illumination and its application to serif mask design including comparing different serif shapes/designs. USPN 5,825,647 to Tsudaka discloses a mask pattern correction method and apparatus including plural evaluation points and automatic optimization. USPN 6,187,483 to Capodieci et al. (commonly assigned) discloses mask quality measurements by Fourier space analysis including determining an optimal OPC design using a mathematical transform.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan J Hesseltine whose telephone number is 703-306-4069. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 703-308-6604. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-0377.

rjh
September 2, 2003

JINGGE WU
PRIMARY EXAMINER